UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/685,289	10/14/2003	Matthew P. Dugas	14505.01	9823

7590 11/14/2008

Devan V. Padmanabhan
DORSEY & WHITNEY LLP
Intellectual Property Department
50 South Sixth Street, Suite 1500
Minneapolis, MN 55402-1498

EXAMINER	
SIEFKE, SAMUEL P	

ART UNIT	PAPER NUMBER
1797	

MAIL DATE	DELIVERY MODE
11/14/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/685,289	DUGAS, MATTHEW P.	
	Examiner	Art Unit	
	SAM P. SIEFKE	1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 October 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *19,20,24-42,45 and 46* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *19-20, 24-42, 45 and 46* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 19, 24-42, 45 and 46 are rejected under 35 U.S.C. 102(e) as being anticipated by Branton et al. (USPN 6,627,067).

Branton discloses a method of forming a membrane structure for evaluation of a polymer molecule that comprises forming a cavity in the membrane. The membrane surface is progressively thinned from the cavity free surface of the substrate until it intersects with the cavity to form an aperture. In fig. 16a, a nanopore gap can be seen, this corresponds to the aperture being of nano-scale size (also col. 8, lines 50-57) In column 11, lines 47, Branton discloses a micro-fabrication method. “Referring to FIG. 4, in an example microfabrication process provided by the invention for forming an aperture in a membrane, a starting substrate 130, e.g., a silicon wafer is provided, as shown in FIG 4A. A selected membrane material, e.g., silicon nitride, is provided as coating layers 132, 134 on the upper and lower surfaces, respectively, if the wafer. In one example, a silicon-rich, low-stress, silicon nitride layer of about 50 nm in thickness

is deposited on the silicon wafer by conventional chemical vapor deposition (CVD) processing." Branton discloses that while the aperture is being thinned, feedback of the apertures diameter can be measured in real time so the diameter of the aperture can be controlled in a precise manner (col. 14, lines 13-42; col. 13, lines 56-65). Branton discloses electron beam lithography which is an equivalent to electron milling because each is employed to remove the thin film in order to create a hole therethrough (col. 13, lines 3-17, col. 13, lines 55-col. 14, line 34). The Examiner notes that in the instant applications specification on page 8, in the 2nd full paragraph, the Applicant states, "a channel 75 is cut through thin film 60 with a focused ion beam 70 **or other suitable precision milling device such as electron beam lithography**..." The Applicant therefore states that electron beam lithography is an equivalent precision milling device capable of making a precise aperture. In col. 13, lines 55-61, "Once the cavity 146 is formed in the membrane, thinning of the membrane is then carried out on either side of the membrane 134." Branton disclose electron lithography for cavity 146, and then electron beam etching for thinning the substrate to the final aperture geometry or additional thinning processes such as ion beam assisted etching, plasma and reactive ion etching (col. 14, lines 13-19). The Examiner maintains that Branton teaches measuring the channel in-situ because the feedback mechanism while etching the hole provides real time control of the aperture formation process, whereby a precise and prespecified aperture diameter can be reliably and reproducibly formed (col. 14, lines 22-42).

The aperture walls are made up of an insulating material. Means for causing the monomers of a candidate polymer molecule to linearly traverse the aperture in single-file order is provided, whereby the polymer molecule interacts with the aperture. A detector is used to identify time-dependent or monomer-dependent interactions of the molecule with the aperture. Additionally, an amplifier or recording mechanism may be used to detect changes in the ionic or electronic conductance across the aperture as the polymer traverses the opening (col. 7, line 59-col. 8, line 6). A first and second electrodes adjacent to or bordering the aperture serve as detectors. The electrodes are positioned so as to monitor the candidate polymer molecules that translocate the aperture (col. 8, lines 21-25). The aperture of the invention is located in a solid-state membrane. The solid state membrane is chemically inert and/or resistant. Exemplary materials include, silicon nitride (Si.sub.3 N.sub.4), alumina (Al.sub.2 O.sub.3), and silica (SiO.sub.2), or plastics such as Teflon or elastomers such as two-component addition-cure silicone rubber. The aperture may be sized to permit interaction of a single-stranded or double-stranded molecule, i.e., the aperture is of a diameter that is similar to the atomic width of the polymer molecule of interest. The membrane may be conducting, in which case, the walls of the aperture may be coated with an insulating layer (col. 8, lines 38-67). An insulating layer is then deposited on the walls of the aperture that is suitable to provide the desired insulating properties and the desired final channel diameter dimensions. The solid-state membrane containing the aperture is provided with a conductive, i.e., metallic, layer or thin film that serves as an electrode. The conductive regions are in close proximity to the aperture for high local sensitivity to

conductance or electronic variations in both the transverse (along the channel) or longitudinal (across the channel opening) directions. The electrodes may be used in conjunction with either ionic or electronic sensing, as is described herein. Branton further discloses a conductive layer on the membrane that is separated into two electrodes by the formation of the aperture and forming conductive layer above and below the membrane thereby forming four electrodes upon forming the aperture. See also (fig. 5a, 8a, 8b, 15; col. 3, 4, 7, 8, 9, 13, 14, 15).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 19, 24-42, 45 and 46 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Branton et al. (USPN 6,627,067) in view of Mehta (USPN 6,426,615).

Mehta teaches an apparatus for analyzing particles suspended in a fluid by passing the particles by applying an electrical charge to the first liquid thereby fording the fluid and particles to pass through an aperture to a second fluid region (abstract, fig. 9). Mehta teaches the hole or aperture in the transducer may be a cylindrical hole. The cylindrical hole can be made by ultrasonic drilling, laser drilling, etched particle tracked process, electron beam milling and the like (col. 7, lines 1-16). It is well known in the art that nanoapurtures can be made by employing the above techniques. Therefore it would have been obvious to one having an ordinary skill in the art at the time of the invention to modify Branton to employ electron beam milling techniques for creating the hole through the thin layer supported on the substrate because electron beam milling is a precise technique for making a nano-scale aperture.

Claims 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Branton et al. (USPN 6,627,067) in view of Nisch et al. (USPN 6,218,663).

Branton discloses a method of forming a membrane structure for evaluation of a polymer molecule that comprises forming a cavity in the membrane as seen above.

Branton does not teach drilling the nano-scale channel by a TEM instrument or a SCRIBE.

Nisch teaches ion etching for local thinning of a sample in transmission electron microscope (TEM) with simultaneous electron microscopic observation (abstract). It would have been obvious to one having an ordinary skill in the art to modify the method of Branton to employ TEM to drill the aperture because it produces simultaneous drilling

and electron microscope observation so that one can observe while drilling. This provides superior and perfect thinning of a membrane.

Response to Arguments

Applicant's arguments filed 10/27/08 have been fully considered but they are not persuasive. Applicant argues, " Branton does not disclose electron beam milling of the cavity. Rather, Branton discloses electron beam lithography or pohotolithography of the cavity." The Examiner notes that in the instant applications specification on page 8, in the 2nd full paragraph, the Applicant states, "a channel 75 is cut through thin film 60 with a focused ion beam 70 **or other suitable precision milling device such as electron beam lithography**..." The Applicant therefore states that electron beam lithography is an equivalent precision milling device capable of making a precise aperture. Further, the Examiner has added a 103 rejection that emphasizes the different techniques that can be employed for making nano-scale apertures.

Applicant argues, "Branton teaches away from electron beam milling since neither step of cavity creation nor thinning is necessary with electron beam milling, as claimed by Applicant." Again, the Examiner points to the instant Applicant's specification where it is stated that electron beam lithography (cavity creation of Branton) is an equivalent to electron beam milling (page 8). Further, it is pointed out that the Applicant's method is a two step process also; a) a hole or window is etched in the silicon substrate and the lower layer of the thin film using standard lithography

techniques, b) creating a channel (aperture) 75 by cutting through thing film 60 with electron beam milling (lithography). It is noted that claim 19 requires a single presentation device for the etching and drilling to create the aperture and measuring is performed. Branton teaches the same method as the instant application and employs a single presentation device for drilling and measuring the size of the aperture.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SAM P. SIEFKE whose telephone number is (571)272-1262. The examiner can normally be reached on M-F 7:00am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jill A. Warden can be reached on 571-272-1700. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Samuel P Siefke/
Primary Examiner, Art Unit 1797